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THE ZOOLOGICAL RESULTS OF THE "CHALLENGER" EXPEDITION

Report on the Scientific Results of the Voyage of H.M.S. "Challenger" during the Years 1873-76 *under the Command of Capt. G. S. Nares, R.N., F.R.S., and Capt. F. T. Thomson, R.N.* Prepared under the Superintendence of the late Sir C. Wyville Thomson, F.R.S., &c., and now of John Murray, one of the Naturalists of the Expedition. Zoology—Vols. XV. and XVI. (Published by Order of Her Majesty's Government, 1886.)

VOLUME XV. contains three Reports on the univalve Mollusca collected. The first is a short Report, by Dr. Rudolph Berg, on the Marseniadæ. This family has slowly gathered round the *Helix perspicua* of Linnæus and the *Bulla latens* of O. F. Müller. These species are found in all seas. The shell is either altogether enveloped in the mantle or is very partially exposed, always either calcareous or horny. Six genera are recognised, with 33 species, 11 of which are described and figured as new.

The great bulk of the volume is taken up with the Report, by the Rev. R. Boog Watson, on the Scaphopoda and Gasteropoda. This laborious memoir occupies over 750 pages, and is illustrated by an atlas of fifty plates. Some 1300 species, new and old, were recognised among the mass collected, and there were some 400 indistinguishable forms. In a short appendix, the Marquis de Folin describes and figures the Cæcidæ. The classification adopted, "for want of a better," is that of the Messrs. Adams. The more important of the general conclusions based on the examination of the facts attending the habitat of all the distinguished forms are as follows:—(1) Depth is an important condition in connection with Molluscan life; (2) but temperature is even a more important condition than depth; (3) great differences in either depth or temperature prove barriers to distribution; (4) where these do not exist, there would seem to be no limit to universality of distribution; (5) there are without doubt such universally distributed forms. The author sees no evidence in the oldest or most widely distributed species of any essential, lasting, and progressive change.

The last Report is on the Polyplacophora, by Prof. A. C. Haddon. The number of Chitons collected was, considering the frequency and wide distribution of the group, surprisingly small. Almost the only shore-collecting done during the cruise was on or near coral-reefs, and Chitons would seem to be rare in such places. The really deep-sea forms belong to Leptochiton, of which 4 species were found, and 2 are new. These species were taken at depths of from 60 to 2300 fathoms. Three plates accompany this Report: two are from drawings by the author, and the third, a coloured plate, gives the portraits of the new species by T. H. Thomas.

Volume XVI. contains the four following Reports:—(1) On the Cephalopoda, by W. Evans Hoyle, M.A. Oxon., Naturalist on the Editorial Staff. In a preface to this valuable Report, the author acknowledges the kindly and generous assistance which he received in its execution from Prof. Steenstrup, of Copenhagen, whose knowledge of the Cephalopods is immense, and the collection under his charge is unrivalled. This Report is almost exclusively systematic in its scope, but we are promised a supplement with anatomical details. It commences with a provisional synopsis of recent Cephalopods, which will certainly be of immense value to all workers. While it is true that no systematic treatment of the class can for some time to come be other than provisional, yet the author seems to have taken the greatest pains that his shall be as natural as possible, and until we have a nearly complete knowledge of the life-history of all the forms, more will not be attainable. This list contains 388 species referred to 68 genera. It would have been, we think, an improvement if all those collected during the Expedition had been in this list distinguished by some special mark, as well as having the recorded habitats for each given. Of the 72 species found, some 32 are described as new, and for these 4 new genera and 1 family had to be established. Out of the 388 species, some 60 or 70 had been so badly described as not to be recognisable, but of some of these no doubt the types still remain. Of the new species, none pertain to those great monster cuttles—source of many a battle. The exceedingly interesting genus Cirroteuthis is enriched with three species—one, *C. magna*, being the giant of the group, and measuring 1155 millimetres in length. The type species of this genus (*C. mülleri*, Esch.) was the only one known until 1883, when a second species was described by Fischer, and now (1885) five new species have been described by Hoyle and Verrill. The balance of the evidence seems to be in favour of all the species being deep-sea forms, though at present there are great difficulties in the way of settling the question. A new genus, Amphitretus, is established for a form in which the mantle is fused with the siphon in the median line, so that there are two openings into the branchial sac. This is a quite unique feature among Cephalopods. The species *A. pelagicus* was taken near the Kermadic Islands. It seems strange that but one specimen of *Argonauta argo* was found, for this and other species are not very rare. Of the genus Octopus, 20 species are enumerated, of which 11 are described as new. The one specimen of *Spirula peronii*, found living off Banda, is referred to, but Prof. Huxley is preparing a report on its anatomy. To the already large genus, Sepia, large additions were made, and it is interesting to note that all of the 10 new species were found between Port Jackson (Australia) and Japan. The shell, or sepiostaire, was found to present differential characters in the species, and a series of new terms has been adopted to describe its various parts. The suckers also seem to offer characters of specific importance, and so possibly will the hectocotylised arms when sufficiently known. Two species of Steenstrup's genus Taonius are recorded, one, *T. hyperboreus*, the common North Atlantic form, and the second the *T.* (*Procalistes*) *suhmi* of Lankester. Willemoes-Suhm had taken it for a Clionid Pteropod. Lankester described it as a new genus; but the author regards it as but a species of Taonius, and with this Prof. Steenstrup agrees, though he thinks that the specimens found may appertain to two species. As in the case of the Argonaut so in that of the Paper Nautilus but a single specimen was found, and that off Mataku, Fiji Islands. A most important means of obtaining specimens seems to have been by the examination of the stomachs of birds, fish, and Cetacea. These creatures seem to be much more satisfactory collectors than the tow-net, in which, though it was so constantly in use, few Cephalopods were taken. Possibly the immense activity of the cuttlefish will account for this. An atlas of thirty-three plates accompanies this Report.

(2) On the Stomatopoda, by W. K. Brooks, Johns Hopkins University. These Crustacea are in their adult forms inhabitants of shallow water. The collection brought home was but small, and contained no startling novelties, so that at first the author was somewhat disappointed ; but this feeling turned to delight when he discovered that the material furnished some excellent opportunities for tracing out, and that with great completeness, the phylogeny and ontogeny of this little order. This order includes about 60 adult species and a vast number of tropical larvæ. The *Challenger* collection of adult forms consisted of only 15 species, 8 of these new, while 2 others had been, to this, very inadequately described ; but the collection of pelagic larval Stomatopods was peculiarly rich, and in Mr. Brooks's hands it has yielded the material for tracing the history of several of the larval types, and also, more remarkable still, for establishing in every genus except one the connection between the adults and their larval types. The larval history of these Stomatopods has been one of the most puzzling problems in morphology, and the very admirable researches of Claus had been the only guide. Though often in error, Mr. Brooks confesses that without Claus's memoir to guide him his own labours must have failed. Unlike most Malacostraca, the Stomatopods, instead of carrying their developing eggs about with them, deposit them in their deep and out-of-the-way burrows under the water. They are thus most difficult to procure, and so difficult to rear that probably not a single instance of a young Stomatopod being reared from the egg is known. The growth of the larvæ is slow, and the larval life long, and, as they are as independent and as much exposed to changes in their environment and to the struggle for existence as the adults, it has come to pass that they as larvæ have undergone countless modifications which have no reference to the life of the adult, and are therefore unrepresented in the adult organism, in which the larvæ differ *inter se* more than the adults do, thus reversing the general rule. The history of each larval type has thus to be traced by the selection and comparison of those larvæ which belong to the series, and in doing this the author was partly guided by general resemblances and partly by a series of comparative measurements. The differences between the genera are slight, and all can be grouped into a single family, Squillidæ. In the description of *Lysiosquilla excavatrix* we have a very interesting account of its habits. The Report concludes with an elaborate account of the various larval forms and their adult connections. Sixteen plates accompany the Report.

(3) On the Reef Corals, by John J. Quelch, B.Sc. Lond. The author apologises for this Report of just 200 pages being so short, as he was limited both as to time and space. A careful perusal of the memoir inclines us to the opinion that no such apology is needed. Without being a monograph, the Report forms a most important contribution to our knowledge, and this not only of the distribution of the reef corals, but also, in many instances, of their structure. The term reef coral is undoubtedly vague, but the forms described in this report belong almost entirely to the Reef Madrepores, descriptions of some few species of Millepores being added. The collection made contained representatives of 293 species referable to 69 genera, and many of the species were represented by series of specimens often presenting a considerable degree of variation. As a proof of how little known are the corals of the Pacific and Indo-Pacific Islands, it may be mentioned that 71 of the new species were found in these regions, while but 2 were from the Atlantic. No attempt has been made to describe the soft parts of the specimens. Special attention is directed to the fact that the descriptions of species apply to specimens in which the calycles are perfect ; in most museum specimens these are generally to be found greatly injured, and then it is often impossible to distinguish between closely-related forms. In the treatment of the distribution of these corals, lists are given of the species obtained at each locality, together with lists of the new species, and of old species recorded from the stations for the first time. While the classification adopted is on the main based on that of Milne-Edwards and Haime, a rather startling novelty in arrangement is the merging of the Madreporia Rugosa with the section of Madreporia Aporosa. The detailed reasons for this are given on pp. 40-43 ; and as a result the author considers that there is not a single characteristic of the old group Rugosa which will essentially separate forms usually included under it from the more typical Astræids. Thus in many Astræids the septa present are not multiples of six, while in some typical Cyathophyllidæ the septa are simply radially arranged, without any indication whatever of a tetrameral type. Again, the presence of a fossula is scarcely even of generic value ; and as to the presence in the adult rugose coral of but two sizes of septa, this phenomenon is not always present in the species, and is to be met with in some typical Astræids ; while as to the tabulæ, which are no doubt very characteristic of the Rugosa as a group, still even these are present in some Astræids, and absent in some Rugosa. In a striking new Madrepore, *Moseleya latistellata*, the characters are to a marked degree intermediate.

There is yet a great deal of work to be done ere the distributional areas of the reef corals is known. Probably the coral fauna of no district, unless that of the Red Sea, has been fairly worked out. It was in the nature of things that the cruise of the *Challenger* could not, from the shortness of its sojourn at any one coral district, do much in this direction. Still some few facts of great interest have been brought to light, one of the most remarkable being the occurrence of an undoubted reef-building species, *Manicina areolata*, in Simon's Bay, between lat. 34° and 35° S., at a depth of from 10 to 20 fathoms, and at a temperature of 65° F., and this is all the more peculiar, as this coral is a well-known West Indian reef-building form. Another coral, *Cladocera arbuscula*, was also found at Simon's Bay, though a West Indian species.

Notes and descriptions of eight species of Millepora are given in an appendix. One new species is called after Mr. Murray, being the one on which he saw the living zooids of this remarkable group of Hydroids. It was *M. nodosa*, occurring at Tahiti, that afforded Prof. Moseley the material for his brilliant confirmation of the observations of L. Agassiz. Twelve plates, the figures on which are beautifully executed by Mr. H. Gawan, accompany this Report.

The concluding Report in this volume is by Prof. Sir William Turner, being on the Human Crania, &c., collected during the cruise. This forms Part 2, being on the bones of the skeleton, and is an Essay on the Comparative Osteology of those Races of Men whose bones are described in the Report, for it incorporates the study not only of the material collected during the cruise of the *Challenger*, but that brought together by the authors' eminent predecessors in the Chair of Anatomy in the University of Edinburgh.

Just a century ago Camper pointed out some of the differences existing between the pelvis of a Negro and a European, and since then a vast amount of information on the subject has been accumulated, and so far as the races described in this Report are concerned, it has been exhaustively treated by Sir W. Turner. He classifies the pelvis into three groups: dolichopellic, with a brim index above 95; mesatipellic, with a brim index from 90 to 95; and platypellic, with index below 90. As to the race and age characters of the pelvis, the details, however interesting, are too technical to be abstracted. In reference to the question of how far the mode of life may act as modifying the transverse diameter of the pelvic brim, we may add that the expression "to sit on one's hunkers," would be readily understood in the North of Ireland, where it is an attitude strictly forbidden to young people. In the section treating of the spinal column, the subjects of peculiarities of individual vertebræ and the lumbar curve are investigated; and in another section the scapula, inferior and superior extremities, are examined. In a concluding section we have a general summary, and an appendix to the first part of the memoir on the "Human Crania," in which some additional details are given of some crania from Australia, the Sandwich Islands, New Guinea, and Fuegia. An index to both parts also accompanies this Report, which is illustrated by three plates of the pelves of different races.

The greater portion of the manuscript of these two large volumes was handed to the editor between July 1885 and July 1886, and the editor is to be congratulated on the successful manner in which this immense amount of scientific matter has been seen through the press.

ELEMENTARY DYNAMICS

Lessons in Elementary Dynamics. Arranged by H. G. Madan, M.A., Assistant Master in Eton College. Pp. 180. (Edinburgh: W. and R. Chambers, 1886.)

IN this little book the author has provided teachers of elementary mechanics with a rich storehouse of materials for experimental demonstrations, although the work is not quite satisfactory in some other respects. His endeavour has been to explain some of the properties of matter, Newton's laws of motion, and the modern conceptions of energy and work, in such a manner as involves only the most elementary knowledge of mathematics. Thus symbolical reasoning and formulæ are dispensed with, and nothing assumed beyond a knowledge of arithmetic and a little easy geometry. There is a successful attempt made to arouse a real interest in the subject by continual reference to phenomena of every-day life, and especially by illustrations drawn from the sports and games of the pupils. In some cases detailed instructions are given for performing the experiments. These are valuable, and similar aid might with advantage be provided in many other instances.

The author is of opinion that mechanics ought to have the first place in a boy's scientific education. This position would be strengthened, if some series of simple experiments, to be performed by the pupils themselves, were provided, and regarded as essential.

Some expressions, such as "above," "below," "on the same level," which are usually left undefined, have their exact scientific meaning pointed out. On the other hand, there is occasionally looseness and confusion in the use of technical terms. For example, in Section 103 we read: "Momentum is the term used to express the *force* with which anything is moving." In Section 159 we have the accurate statement that, by finding the momentum of a body, we learn what *impulse* has been applied to it: here the accepted expression for the time-integral of a force is used, but we do not notice any definition of the word "impulse"; and the exposition of the second law of motion appears vague in consequence. Similarly, the *force* exerted in throwing a cricket-ball is spoken of in Section 156, where the time-integral of the force is in question.

Section 302 is devoted to the "exact valuation of the energy in a moving body," and the usual expression—energy $= \frac{1}{2}(\text{mass} \times \text{velocity}^2)$—is obtained, but by a process which is at least startling. Witness these statements:—"If the work could be done *in an instant*, the energy would be exactly expressed by the product of the mass × velocity^2;" and again, "The whole amount of work which a moving body can do in the time during which its motion is being stopped will correspond to the *average* or *mean* amount of energy between that which it has at the beginning of the time and that which it has at the end of the time." *Unde, quo veni?*

After the preceding, it is a small matter to refer to Section 311, where this statement occurs: "The motion of the pendulum is an accelerated motion, and, as in al other uniformly accelerated motions, the spaces described are as the squares of the times." Here, of course the reasoning is fallacious; and, although the proof intended is sound, it involves the doctrine of limits, and wants development. It is surely better at this stage of the pupil's progress to rely on the experiments in Section 312.

There is an appendix on the metric system, and, in conclusion, a dozen pages of questions and exercises on the several chapters of the book. A. R. W.

OUR BOOK SHELF

Food-Grains of India. By A. H. Church, M.A. (London: Chapman and Hall, 1886.)

A WELL-WRITTEN, well-illustrated, and well-turned-out volume. Its thinness only enhances its elegance. Its illustrations, by Mr. G. W. Ruffles, are charming, clear,